



An Inca silver figurine at National Museums Scotland: Technological study

Una estatuilla inca en plata del National Museums Scotland: estudio tecnológico

Une figurine Inca en argent au National Museums Scotland: étude technologique

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An Inca silver figurine at National Museums Scotland: Technological study

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Abstract

The hollow silver male miniature figurine from National Museums Scotland is one of the tallest specimens made in precious metals attributed to the Incas. In spite of showing the expected characteristics of this type of Inca production for ritual offerings—regular proportions and standing pose, representation of its gender, bulging cheek associated to coca leaves chewing and elongated earlobes—this figurine differs from the regular figurines by the form of the top of its head. In addition, the skilled decoration includes details such as well portrayed feet. The technologies and the alloy employed in its manufacture were examined using a stereo microscope and by non-destructive X-ray fluorescence analysis. Comparison between this figurine with the hollow silver male figurines of equivalent stature and typology kept at Dumbarton Oaks Research Library and Collection and Museum of America shows that they are all made with the same technology and by employing silver alloys with copper contents below 0.5%. These alloys are richer in silver than the majority of the alloys employed to fabricate normal Inca hollow figurines of known provenance or from other museum collections.

Keywords: *miniature figurine, tall specimen, Inca, silver, analysis, alloy*

Una estatuilla inca en plata del National Museums Scotland: estudio tecnológico

Resumen

La estatuilla miniatura en plata laminada perteneciente al National Museums Scotland es uno de los ejemplares en metal precioso de mayor tamaño atribuido a los incas. A pesar de tener las características

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esperadas para ese tipo de producción inca —proporciones y postura regulares, representación del sexo, la protuberancia de la bola de hojas de coca y los lóbulos de oreja alargados—, esta estatuilla difiere de las estatuillas más típicas por la forma de la parte superior de su cabeza. A esto se suma la calidad de su decoración, que incluye detalles como la representación realista de los pies. Las tecnologías y aleaciones utilizadas en la fabricación de la estatuilla fueron determinadas por microscopia óptica y fluorescencia de rayos X. La comparación de los resultados obtenidos con los que fueron publicados sobre tres otras estatuillas en plata laminada de tamaño y tipología similares, pertenecientes al Dumbarton Oaks Research Library and Collection y al Museo de América, muestra que todos los objetos fueron fabricados con la misma tecnología y con aleaciones de plata que contienen concentraciones de cobre inferiores a 0,5%. Estas aleaciones contienen más plata que la mayoría de las aleaciones empleadas en la fabricación de las estatuillas incas tradicionales cuya proveniencia es conocida o provienen de otras colecciones de museo.

Palabras clave: estatuillas miniaturas, gran tamaño, Inca, plata, análisis, aleación

Une figurine Inca en argent au National Museums Scotland: étude technologique

Résumé

La figurine miniature creuse en argent conservée au National Museums Scotland est un des plus grands spécimens en métal précieux attribué aux Incas. Malgré la présence des caractéristiques espérées pour ce type de production inca dédié à usage rituel —proportions et posture régulières, figuration du sexe, protubérance évoquant la mastication de feuilles de coca et lobes d'oreilles étirés— cette figurine se singularise par la forme atypique de son couvre-chef. À ce fait vient s'ajouter la très fine décoration qui inclut des détails comme la représentation très réaliste des pieds. Les technologies utilisées dans sa fabrication ainsi que les alliages ont été déterminés au moyen de la microscopie optique et par la spectrométrie de fluorescence à rayons-X. La comparaison des résultats obtenus avec les données publiées pour trois autres figurines creuses en argent de même taille et de même typologie, appartenant à la Dumbarton Oaks Research Library and Collection et au Museo de América, montre que tous ces objets ont été fabriqués avec la même technologie, à partir d'alliages d'argent qui contiennent des concentrations de cuivre inférieures à 0,5%. Ces alliages sont plus riches en argent que la majorité des alliages employés dans la fabrication de figurines creuses inca dont la provenance est connue ou qui appartiennent à d'autres collections muséales.

Mots-clés : figurines miniatures, grande taille, Inca, argent, analyse, alliage

INTRODUCTION

Among the anthropomorphic miniature figurines made from precious metals and attributed to the Incas, a few stand out from the known specimens because of their size. The figurines produced by hammering and casting and used in ritual offerings and ceremonies (in the so-called *capacocha* ceremony) are often found dressed with wool and cotton garments and feathers in the rare mountaintop shrines known. They follow certain standardised parameters of production.

The few specimens found in known archaeological sites are insufficient to provide all the keys for us to understand their typology and the technologies employed. The study carried out by Dransart on several anthropomorphic figurines either from archaeological contexts or kept in museum collections, many with unknown provenance, showed however that in general these objects range from 5 cm to 15 cm (Dransart, 2000). Those belonging to two mountaintop shrines included in that study, Cerro El Plomo in Chile (Mostny, 1957-1959: 46) and Cerro Aconcagua in Argentina (Schobinger, 2001) are in fact 10 cm and 5 cm tall respectively. It should be emphasised that the zoomorphic and anthropomorphic miniature figurines from the shrines of three sacrificed children found by Reinhard on the top of Vulcan Lullaillaco in Argentina (Reinhard & Ceruti, 2005), not included in Dransart's study, match the range of stature suggested. Their stature ranges from 3 cm to 15 cm (Mignone, 2015).

The list prepared by Dransart (Dransart, 1995) shows however that there is a difference between the figurines from high altitude mountain shrines and those which are now in museum collections. The stature of the first type ranges from 3.5 cm to 14 cm, but the latter are taller, ranging from 5.2 cm to 24.5 cm. It should also be noted that other figurines are very small, for example the gold figurines found in archaeological sites in the district of Cusco in Peru, in particular in Lucre and Qorikancha (Valencia, 1981), which like the figurines from the Lullaillaco shrines were not included in Dransart's study, are only 3 cm tall. Two hollow male figurines found by Reinhard inside an andesite box in Lake Titicaca were also 3 cm tall (Reinhard, 1992: 141, fig. 21).

Tall metallic figurines are seldom found in archaeological excavations. The 24 cm tall male figurine from funerary context 9 in the site of Choquepujio nearby Cusco (Gibaja Oviedo et al., 2014: 165-166), with an atypical head top made from metal and spondylus shell¹, is so far an exception. The two tallest figurines in Dransart's list (pages 56-57) are the 24.5 cm tall hollow gold female from Walla-Walla (near Lauramarca, district of Cusco) belonging to the *Museo Inka* (ancient Archaeological Museum of Cusco from the Universidad Nacional San Antonio de Abad del Cusco) and the 23 cm tall hollow silver male figurine from National

¹ Description by Gibaja Oviedo et al. (2014: 165-166): «un personaje realizado en metal laminado y con un tocado hecho con concha *Spondylus* de 24 cm de largo. Este objeto debió haber estado cubierto por tejido, ya que se recuperó pequeños hilos muy delgados al parecer de fibra de vicuña. Esta escultura representa a un 'orejón', o personaje de la nobleza Inca, según lo indican las orejas alargadas. El personaje al parecer estaría masticando coca, con las manos sobre el pecho, los dedos juntos y el miembro viril erecto. El tocado circular está elaborado en metal delgado a manera de hilo. Completa este atuendo un objeto laminado de forma trapezoidal de metal que se ubica en la frente, en cuya parte central colocaron una cuenta pequeña de concha» (translation by the authors: "a 24 cm tall figurine made from hammered metal and a headdress made from *Spondylus* shell. The object was certainly covered with textiles, because small and very thin threads certainly of vicuña fiber could be recovered. This personage is an 'orejón', or noble Inca, as shown by his big ears. The personage seems to chew coca leaves, his hands are placed over his chest, his fingers are joined, and his male member is in erection. The circular headdress is made from thin metal like a wire, completed by a metal hammered object of trapezoidal form that is placed on the front, presenting on its central part a small shell bead").

Museums Scotland (NMS). One partial image is provided for the first by Doëring (1952: 45) showing that this figurine is typologically very close to the 24 cm tall hollow gold female specimen of unknown provenance, accession number 5/4120, from the National Museum of the American Indian (Washington D.C.).² This was bought in Panama by Dexter, and photographs can be seen online³, one of which was published for example by Emmerich (1965: 46).

The hollow silver male figurine belonging to NMS is therefore included in the small group of silver and gold specimens larger than 15 cm. The figurine was published several years ago by Idiens (1971: 3) and this object became renowned not only because it is one of the largest specimens attributed to the Incas, but also because of the unusual shape of the top of its head and its highly skilled manufacture. The Incan male anthropomorphic figurines regularly display standardised proportions and poses; their gender is usually represented, as is the bulging cheek associated with the chewing of coca leaves. Their high status is distinguished by elongated earlobes to wear earpools and the *llautu* around the head. The *llautu* is a braided headband that the Inca nobility twisted around their head; it could be enhanced with feathers and a gold plaque⁴. Drawings of *llautus* can for example be seen in the *El primer nueva corónica y buen gobierno* written in 1613 by Guamán Poma de Ayala (González Vargas et al., 2003: 95). The child sacrificed in the *capacocha* of Cerro El Plomo also wore the *llautu* that merely consisted in this case of a black thread made from human hair twisted five times around his head (Mostny, ed., 1957-1959: 34-36).

The form of the head top of the figurine from NMS collection is therefore unexpected. Its form suggests the location where a possible headband, perhaps made from another material (possibly organic⁵ or in spondylus shell and metal like in the case of the figurine from the site of Choquepujio cited above), could originally have been attached or twisted. Two other hollow silver male figurines of this type, also skilfully made and with the same type of head top, both 22.7 cm tall, can be cited: the specimen from Dumbarton Oaks Research Library and Collection (Dumbarton Oaks RLC) in Washington, D. C. (Rowe, 1996: 307), accession number PC.B.474⁶, an acquisition from the Gaffron collection (Berlin),

² It should be emphasized that in contrast to the figurine from Walla-Walla, the specimen from the Museum of the American Indian has the nails enhanced by chasing.

³ See <http://www.nmai.si.edu/searchcollections/item.aspx?irn=58413&catid=2&cultxt=inca&objmattxt=gold&src=1-5>.

⁴ Description by Cieza de León (1880: 24): «en la cabeza se ponía unas trenzas o llauto, que llaman pillaca, que es como corona, debajo del cual colgaban unas orejeras de oro y encima se ponía un bonete de pluma casi como diadema que ellos llaman paucarchuco» (translation by the authors: “on the heads was placed some braids or *llautu*, that they call pillaca, which is like a crown, under which hanged gold earrings and on which was placed a cap made from feathers, like a diadem that they called paucarchuco”).

⁵ We note the silver hollow male figurine shown, for example, in the catalogue of the exhibition “Circa 1492: Art in the Age of Exploration” said to belong to the Museum Rietberg in Zurich (Levenson, 1991: 592). The figurine has around its head a textile headband.

⁶ See <http://museum.doaks.org/Obj23036?sid=3628&x=16461&port=2639>.

and the specimen from Museum of America in Madrid, accession number MA 07432, where no information on the acquisition is provided either in the online catalogue⁷ or in Cuesta Domingo & Rovira Lloréns (1982). Another hollow silver figurine of unknown provenance from Museum of America, accession number MA 07432, less skilfully made than the previous three, is 23.1 cm tall and presents the same type of head top.

The aim of this study was to assess the technologies and alloys used in the manufacture of the silver figurine from NMS, using non-destructive optical microscopy and X-ray fluorescence analysis. The results obtained were then compared for any similarity with the published data for the specimens from Dumbarton Oaks RLC and Museum of America. We also discuss differences and similarities of production by comparing these data with data published for the regular Inca hollow silver figurines that could so far be submitted to examination and analysis.

1. TECHNIQUES OF MANUFACTURE

The silver male figurine (Acc. N°: A.1951.210, fig. 1) came to the collections of NMS in 1951 as a gift from the Wellcome Institute for the History of Medicine in London. Its origin remains unknown. Like regular Incan male anthropomorphic figurines, this figurine, as referred above, has the expected proportions and standing pose, with the arms bent on its chest and on its face the protuberance due to the chewing of coca leaves. Its gender is represented, and its earlobes are elongated to receive earpools.

The figurine was visually examined under stereomicroscope using a Leica S8APO Stereo Microscope coupled with a Leica MC170 HD camera and LAS image software (ver4.6). The figurine was produced by rolling and joining several hammered silver foils. This mounting is commonly observed for all the silver hollow male Inca figurines known. A description can be found in publications by Schuler-Schömig (1981: 22-24) for figurines from the collection of the Ethnologisches Museum in Berlin, and by Rowe (1996: 305 and 308) for the figurine from the Dumbarton Oaks RLC typologically similar to the specimen from the NMS under study.

The largest silver foil was used to form the head, the body, and the legs in *repoussé*. After forming and rolling, this foil is soldered on the back and on the inner part of the legs. One small bent silver sheet is soldered in the inner part of the legs to close the body. The solders seams can clearly be seen, as illustrated on figure 2.

The top of the head, the sex, the ears and the feet are made independently and then soldered to the main part of the figurine. The head top consists of three components soldered together and then soldered to the body, as shown in figure 3. One cylindrical element made from a rolled silver sheet rests on another silver sheet that closes the top of the main body. A third element, concave and nowadays pierced, covers the cylinder.

⁷ See <http://ceres.mcu.es/pages/Viewer?accion=4&AMuseo=MAM&Museo=MAM&Ninv=07432>.



Figure 1 – Silver male figurine (Acc. N°: A.1951.210)

Dimensions: Height 230 mm; Width 51 mm; Depth 50 mm

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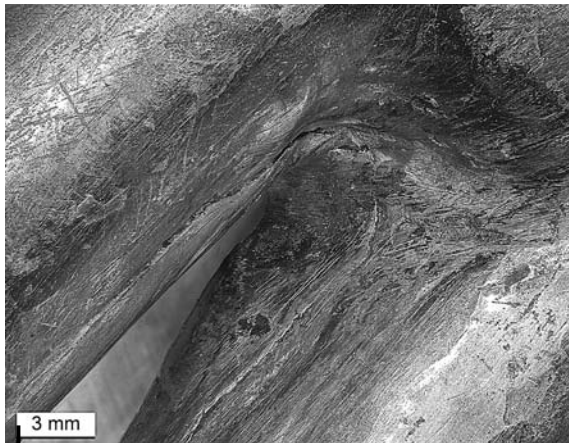


Figure 2 – Like on the back of figurine, in the inner part of the legs the seams that correspond to the soldering of the main sheet and to the soldering of the small finishing sheet to the main sheet are visible

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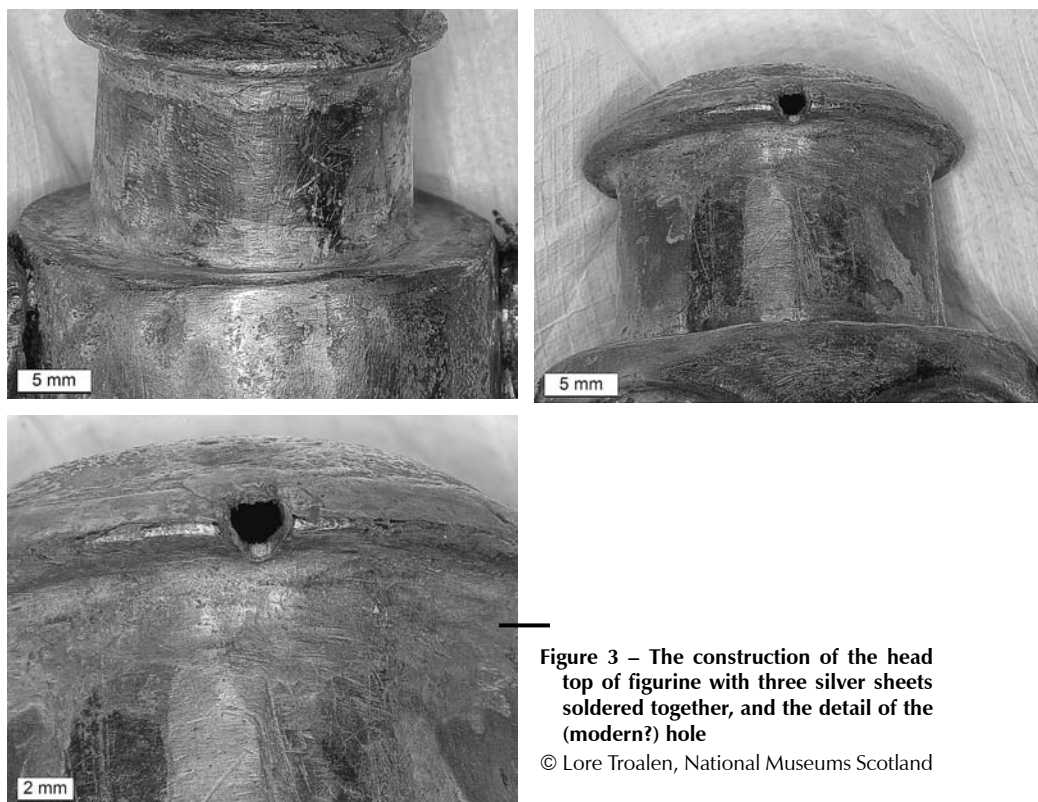


Figure 3 – The construction of the head top of figurine with three silver sheets soldered together, and the detail of the (modern?) hole

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Figure 4 illustrates the earlobes which are made from cut hammered silver strips decorated in *repoussé*. The solder is apparent on the back of the earlobes. The sex was similarly made by rolling and soldering one silver sheet that is then inserted in a hole and soldered to the body.

The arms are modelled by *repoussé* in the main silver sheet. To accentuate the fingers, the hands are enhanced by chasing as shown on figure 5. The feet are similarly made from silver sheets in *repoussé* where the fingers were enhanced by chasing (fig. 5). The feet consist of two elements soldered together in order to obtain a three-dimensional element that is then soldered to the main body. It was not possible to observe in detail the mounting of the feet as the figurine is today glued to a Perspex mount for display.

2. THE SILVER ALLOY

The elemental composition of the figurine was obtained by X-ray Fluorescence (XRF) using an Oxford ED 2000 air path instrument analysis, with a Rhodium target X-ray tube and the beam collimated to a point of about 2 mm × 1.5 mm,

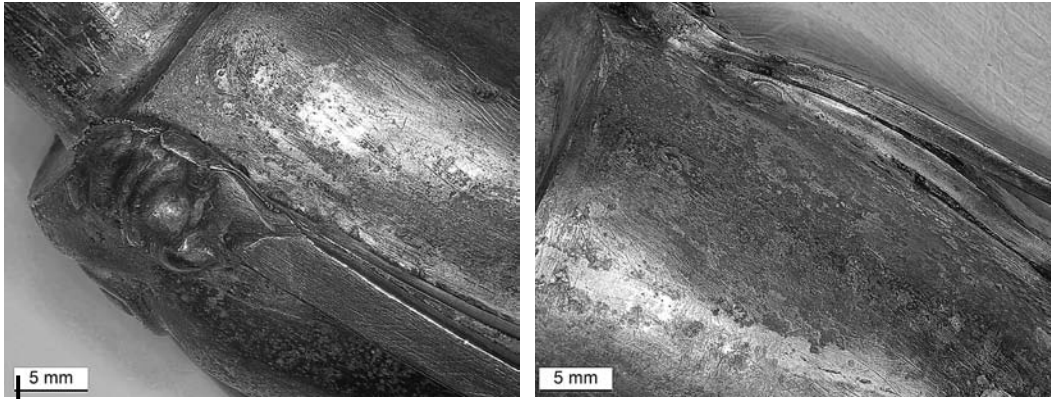


Figure 4 – The earlobes of figurine made independently from rectangular section silver strips cut and decorated in *repoussé*. The solder is apparent on the back

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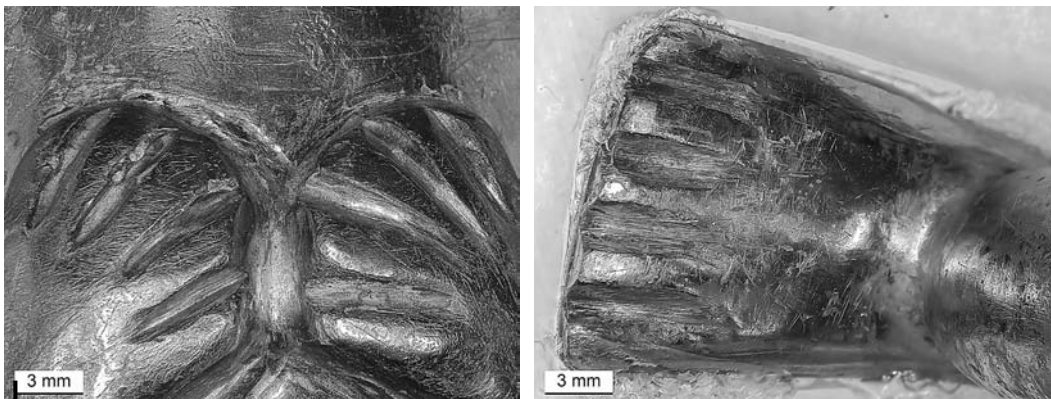


Figure 5 – The hands and toes of the figurine made in *repoussé* and then enhanced by chasing

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coupled to Si(Li) detector. Conditions were for silver analysis: 45 kV, 1000 μ A with 0.125-mm rhodium filter for 150 s and then 50 kV, 1000 μ A, 0.5-mm copper filter for 300 s. Spectral deconvolution and quantification were performed using ED 2000SW software. Quantification was evaluated using a certified silver standard from AGA3 MBH Ltd. containing about 5wt% copper and other elements in the range of 1 to 0.1wt% (lead, gold, zinc, tin, bismuth, antimony and iron). The analysis was undertaken without any surface preparation; the values presented in Table 1 should therefore be taken as quantitative analysis of the surface of the object and might not correspond to the bulk of the metal.

Table 1 – Data obtained by XRF for the different parts of figurine A.1951.210

Values indicated n.d. were not determined, as below the limit of quantification achieved on the unit

| | wt% | | | | | | | | |
|-----------------------|------|-----|------|-------|------|------|------|------|------|
| | Ag | Cu | Au | Pb | Sb | Fe | Zn | Bi | Sn |
| AGA3 MBH | | | | | | | | | |
| Mean (3 measurements) | 91.4 | 4.4 | 0.2 | 2.0 | 0.6 | 0.2 | 1.0 | 0.05 | 0.3 |
| Certified values | 90.7 | 4.9 | 0.3 | 1.9 | 0.4 | 0.02 | 0.9 | 0.05 | 0.9 |
| A.1951.210 | | | | | | | | | |
| Body, front | 99.3 | 0.4 | n.d. | n.d. | 0.3 | n.d. | n.d. | n.d. | n.d. |
| Body, back | 99.1 | 0.5 | n.d. | 0.1 | 0.3 | n.d. | n.d. | n.d. | n.d. |
| Right ear | 98.7 | 0.8 | 0.5 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| Left ear | 98.7 | 0.8 | 0.4 | n.d. | 0.1 | n.d. | n.d. | n.d. | n.d. |
| Head, top | 99.3 | 0.5 | n.d. | n.d. | 0.2 | n.d. | n.d. | n.d. | n.d. |
| Head, back | 99.1 | 0.5 | n.d. | n.d. | 0.1 | 0.3 | n.d. | n.d. | n.d. |
| Sex | 98.9 | 0.6 | n.d. | 0.1 | 0.3 | 0.1 | n.d. | n.d. | n.d. |
| Joining areas: | | | | | | | | | |
| Right ear, back | 97.2 | 2.6 | n.d. | 0.1 | n.d. | n.d. | n.d. | n.d. | n.d. |
| Right ear, back | 96.7 | 2.9 | n.d. | < 0.1 | 0.1 | 0.2 | n.d. | n.d. | n.d. |
| Seam, back of the leg | 97.3 | 2.1 | n.d. | n.d. | 0.3 | 0.3 | n.d. | n.d. | n.d. |
| Head, back | 98.4 | 1.2 | n.d. | 0.1 | 0.3 | n.d. | n.d. | n.d. | n.d. |

Several analyses were carried on the different parts of the figurine. Table 1 summarises the data obtained for the primary chemical elements: silver (Ag), copper (Cu), gold (Au), lead (Pb), antimony (Sb) and iron (Fe). Zinc (Zn) and tin (Sn) were also searched for, but were not detected. The different parts of the figurine were all made from the same alloy which is a very high quality silver alloy, containing less than 1wt% copper. Lead could be detected in three regions of analysis, gold in two regions and iron in four regions. Their contents are under 0.1wt%, 0.5wt% and 0.3wt%, respectively. The presence of low lead and tin contents is expected for low refined silver obtained by cupellation, and minor amounts of gold is reported for silver samples from refined and unrefined silver ores from Peru and Chili (for example, Zori & Tropper, 2010; Rivet & Arsendaux, 1946).

The composition of this figurine matches the data published by Rovira (Rovira Lloréns & Gómez Ramos, 1995; Rovira, in this volume) for the two hollow figurines from Museum of America (tab. 2), accession numbers MA 07432 (which is the most similar to the NMS specimen) and MA 07431 (which is less skilfully made). The alloys of these three figurines contain more than 99wt% silver. The use of almost pure silver seems to be a characteristic of the figurines with atypical head tops. As far as we know, the composition of the figurine from the Dumbarton Oaks RLC is not available.

Table 2 – Composition of the two figurines from Museum of America

See Rovira Lloréns & Gómez Ramos (1995) and Rovira (in this volume)

| Accession number | wt% | | | |
|------------------|------|------|------|------|
| | Ag | Cu | Au | Sb |
| MA 7431 | 99.8 | 0.15 | | |
| MA 7432 | 99.0 | | 0.53 | 0.05 |

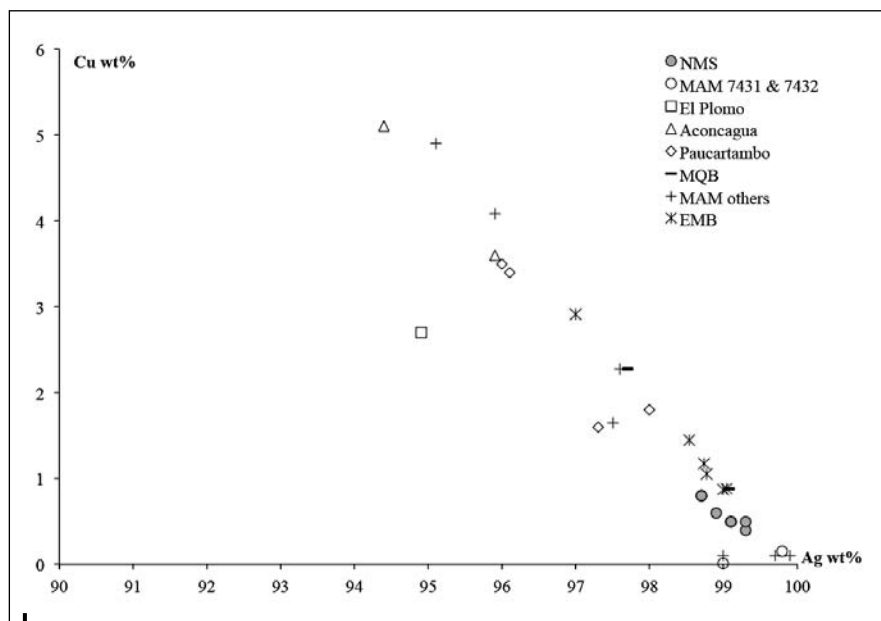
Some joining areas are so thick, as shown in figures 2, 3 and 4, that we could estimate the composition of the solder. Due to the X-ray beam spot diameter, the data obtained are however a combination of the silver sheet composition and that of the solder. If the data obtained for the four joining areas, summarised on Table 1, are not exactly representative of the solder, the evident increase of the copper content from that of the metal sheet, which reaches almost 3wt%, clearly demonstrates that a copper-silver hard-solder was used to join the parts. It is also this type of solder that Rowe suggested for the mounting of the specimen from Dumbarton Oaks RLC (Rowe, 1996).

At this point, and knowing that only few objects have ever been analysed, it is difficult to go further with the interpretation of the results obtained for the NMS figurine. We can however focus on the comparison of the alloys used in the production of the few hollow silver figurines of traditional Inca type published so far.

The composition of the hollow silver figurines from the two mountaintop shrines Cerro El Plomo in Chile and Cerro Aconcagua in Argentina were published several years ago. Data published by Oberhauser & Fuhrmann (1957-1959) for the female figurine with miniature pin (called *tupu*⁸) from El Plomo and for the male figurine from Cerro Aconcagua (Bárcena, 2004) shows the use of high quality silver alloys attaining 95-96wt% silver. In spite of the use of alloys containing these high silver contents, the values still are lower than those measured for the figurines with atypical head tops.

⁸ The *tupu* is a metallic pin used to fasten women's garments (Vetter, 2007; Fernández Murillo, 2015). When dressed, the Inca figurines exhibit on their chests one or two *tupus* with usually round head to fasten their mantles (called *lliklla*).

Figure 6 compares the composition of the different parts of the NMS figurine with the composition of the two figurines of identical typology from Museum of America and the contextualised figurines and the *tupu* from the two mountaintop shrines cited above. The figurine from Cerro Aconcagua made from an alloy with high gold content (about 1.6wt%) slightly deviates from the other objects. We have added to the graph several published silver hollow figurines of regular types, some of known origin and others of unknown provenance held in museum collections. We selected the silver hollow anthropomorphic and zoomorphic figurines of regular type from the Museum of America published by Rovira Lloréns & Gómez Ramos (1995) and those also of regular type from the collection of the Ethnologisches Museum in Berlin⁹, published by Guerra *et al.* (in this volume). Additionally, we also included in the diagram the hollow silver figurines from the site of Chimur in Paucartambo, district of Cusco, nowadays kept in the Inka Museum in Cusco, published by Sierra & Guerra (in this volume), and the two hollow silver figurines



from the *musée du quai Branly - Jacques Chirac* in Paris, published by Núñez-Regueiro et al. (in this volume).

All the figurines show copper contents below 5wt%. Alloys richer in silver were used in the production of the figurines from the NMS and Museum of America with atypical head tops and also for some figurines also belonging to the Museum of America. The majority of the figurines belonging to the Ethnologisches Museum almost match this group as does one of the figurines from the *musée du quai Branly - Jacques Chirac*. Among the figurines belonging to the Ethnologisches Museum, are those attributed to the Island of the Moon in Lake Titicaca (see Guerra et al., in this volume, for more details). The figurines from the site of Chimur in Paucartambo and from the two mountaintop shrines show higher copper contents, but it should be emphasised that the difference is very small.

CONCLUSIONS

The silver male figurine from the NMS collections has the standardised Inca proportions and pose; its gender is represented like the bulging cheek from chewing of coca leaves, and the signs of male Inca noblesse are present, such as the elongated earlobes and the headband (*llautu*) that seems nowadays to miss. The object was skilfully produced with the technology expected for this type of Inca male figurine production: different silver foils were hammered and then rolled and hard-soldered. The anatomic details were obtained by *repoussé*, sometimes enhanced by chasing. The earlobes, the sex, the head top, and the feet were made separately to be then hard-soldered to the body.

In addition to its size and the well portrayed feet, details that can be observed on other Inca figurines, the shape of the top of its head is different from the expected one. Only other three male figurines with similar head tops are known, all tall in hollow silver. Their technology is the same. One belongs to the Dumbarton Oaks RLC and the other two to the Museum of America. There is no published composition for the former, but the two figurines from the Museum of America are made from a very rich silver alloy containing less than 0.2wt% copper. The analysis of the alloys employed in the fabrication of the NMS male figurine also shows the use of a very rich silver alloy only containing 0.5wt% copper. The few hollow silver figurines of known provenance so far analysed are also all made with rich silver alloys, but the concentration of copper may attain 5wt%.

Curiously, among the silver hollow figurines from the Ethnologisches Museum made with the expected Inca technology, one 22.9 cm tall female specimen (accession number V A 28917) has an atypical hair fastening and is made from an alloy that only contains 0.8wt% copper (Guerra et al., in this volume). However, the three figurines belonging to the Museum of America that also have copper contents below 0.5wt% are of different sizes and typologies and their provenance is unknown. This fact is not in favour of the possible use of very high quality silver alloys to produce the tallest figurines.

Knowing that the majority of the objects analysed have neither origin nor context, it is difficult at present to go further on the interpretation of the results obtained for the NMS figurine.

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